

**Claims**

1 Claim 1 (original): A computer program product for sending Transmission Control Protocol  
2 (TCP) messages through HyperText Transfer Protocol (HTTP) systems, the computer program  
3 product embodied on one or more computer-readable media and comprising:

4 computer-readable program code means for establishing a send channel from a first  
5 component on a client side of a network connection, through one or more HTTP-based systems,  
6 to a second component on a remote side of the network connection;

7 computer-readable program code means for establishing a receive channel from the first  
8 component, through the one or more HTTP-based systems, to the second component;

9 computer-readable program code means for establishing a first TCP connection from a  
10 client on the client side to the first component;

11 computer-readable program code means for establishing a second TCP connection from  
12 the second component to a target server on the remote side;

13 computer-readable program code means for transmitting client-initiated TCP requests  
14 from the client to the target server on the send channel; and

15 computer-readable program code means for transmitting server-initiated TCP requests  
16 from the target server to the client on the receive channel.

1 Claim 2 (original): The computer program product according to Claim 1, wherein the computer-  
2 readable program code means for transmitting client-initiated TCP requests further comprises:

3 computer-readable program code means for receiving a client-initiated TCP request from  
4 the client at the first component on the first TCP connection;

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5 computer-readable program code means for packaging the received client-initiated TCP  
6 request in an HTTP POST request message;

7 computer-readable program code means for sending the HTTP POST request message to  
8 the second component on the network connection;

9 computer-readable program code means for receiving the sent HTTP POST request  
10 message at the second component;

11 computer-readable program code means for extracting the client-initiated TCP request  
12 from the received HTTP POST request message; and

13 computer-readable program code means for forwarding the extracted client-initiated TCP  
14 request to the target server on the second TCP connection.

1 Claim 3 (original): The computer program product according to Claim 2, wherein the computer-  
2 readable program code means for transmitting client-initiated TCP requests further comprises  
3 computer-readable program code means for acknowledging the HTTP POST request by sending  
4 an HTTP POST response from the second component to the first component on the network  
5 connection.

1 Claim 4 (original): The computer program product according to Claim 3, wherein the computer-  
2 readable program code means for establishing the send channel operates in response to the  
3 computer-readable program code means for receiving the client-initiated TCP request, and  
4 wherein the computer-readable program code means for transmitting client-initiated TCP requests  
5 further comprises:

6 computer-readable program code means for receiving the HTTP POST response at the  
7 first component; and

8 computer-readable program code means for closing the send channel, responsive to  
9 operation of the computer-readable program code means for receiving the HTTP POST response.

1 Claim 5 (original): The computer program product according to Claim 1, wherein the computer-  
2 readable program code means for transmitting server-initiated TCP requests further comprises:

3 computer-readable program code means for sending an HTTP GET request message from  
4 the first component to the second component on the network connection;

5 computer-readable program code means for receiving the sent HTTP GET request  
6 message at the second component;

7 computer-readable program code means for receiving a server-initiated TCP request from  
8 the target server at the second component on the second TCP connection;

9 computer-readable program code means for packaging the received server-initiated TCP  
10 request in an HTTP GET response message which acknowledges the received HTTP GET  
11 request message;

12 computer-readable program code means for sending the HTTP GET response message  
13 from the second component to the first component on the network connection;

14 computer-readable program code means for receiving the sent HTTP GET response  
15 message at the first component;

16 computer-readable program code means for extracting the server-initiated TCP request  
17 from the received HTTP GET response message; and

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18 computer-readable program code means for forwarding the extracted server-initiated TCP  
19 request to the client on the first TCP connection.

1 Claim 6 (original): The computer program product according to Claim 5, wherein the computer-  
2 readable program code means for transmitting server-initiated TCP requests further comprises:  
3 computer-readable program code means for performing a read operation on the second  
4 TCP connection, responsive to operation of the computer-readable program code means for  
5 receiving the sent HTTP GET request message and prior to operation of the computer-readable  
6 program code means for receiving the server-initiated TCP request; and  
7 computer-readable program code means for using the received server-initiated TCP  
8 request as a result of the read operation, thereby triggering operation of the computer-readable  
9 program code means for packaging the received server-initiated TCP request in the HTTP GET  
10 response message.

1 Claim 7 (original): The computer program product according to Claim 5, wherein the computer-  
2 readable program code means for transmitting server-initiated TCP requests further comprises  
3 computer-readable program code means for preparing to receive another server-initiated TCP  
4 request by triggering operation of the computer-readable program code means for sending the  
5 HTTP GET request message from the first component to the second component, responsive to  
6 operation of the computer-readable program code means for receiving the sent HTTP GET  
7 response message at the first component.

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1 Claim 8 (original): The computer program product according to Claim 2, wherein a Multi-  
2 Purpose Internet Mail Extensions (MIME) type of the HTTP POST request message is set to  
3 "binary/tcp".

1 Claim 9 (original): The computer program product according to Claim 5, wherein a Multi-  
2 Purpose Internet Mail Extensions (MIME) type of the HTTP GET request message is set to  
3 "binary/tcp".

1 Claim 10 (original): A system for sending Transmission Control Protocol (TCP) messages  
2 through HyperText Transfer Protocol (HTTP) systems, comprising:

3 means for establishing a send channel from a first component on a client side of a network  
4 connection, through one or more HTTP-based systems, to a second component on a remote side  
5 of the network connection;

6 means for establishing a receive channel from the first component, through the one or  
7 more HTTP-based systems, to the second component;

8 means for establishing a first TCP connection from a client on the client side to the first  
9 component;

10 means for establishing a second TCP connection from the second component to a target  
11 server on the remote side;

12 means for transmitting client-initiated TCP requests from the client to the target server on  
13 the send channel; and

14 means for transmitting server-initiated TCP requests from the target server to the client on

15 the receive channel.

1 Claim 11 (original): The system according to Claim 10, wherein the means for transmitting client-  
2 initiated TCP requests further comprises:

3 means for receiving a client-initiated TCP request from the client at the first component on  
4 the first TCP connection;

5 means for packaging the received client-initiated TCP request in an HTTP POST request  
6 message;

7 means for sending the HTTP POST request message to the second component on the  
8 network connection;

9 means for receiving the sent HTTP POST request message at the second component;

10 means for extracting the client-initiated TCP request from the received HTTP POST  
11 request message; and

12 means for forwarding the extracted client-initiated TCP request to the target server on the  
13 second TCP connection.

1 Claim 12 (original): The system according to Claim 11, wherein the means for transmitting client-  
2 initiated TCP requests further comprises means for acknowledging the HTTP POST request by  
3 sending an HTTP POST response from the second component to the first component on the  
4 network connection.

1 Claim 13 (original): The system according to Claim 12, wherein the means for establishing the

2 send channel operates in response to the means for receiving the client-initiated TCP request, and  
3 wherein the means for transmitting client-initiated TCP requests further comprises:  
4 means for receiving the HTTP POST response at the first component; and  
5 means for closing the send channel, responsive to operation of the means for receiving the  
6 HTTP POST response.

1 Claim 14 (original): The system according to Claim 10, wherein the means for transmitting  
2 server-initiated TCP requests further comprises:  
3 means for sending an HTTP GET request message from the first component to the second  
4 component on the network connection;  
5 means for receiving the sent HTTP GET request message at the second component;  
6 means for receiving a server-initiated TCP request from the target server at the second  
7 component on the second TCP connection;  
8 means for packaging the received server-initiated TCP request in an HTTP GET response  
9 message which acknowledges the received HTTP GET request message;  
10 means for sending the HTTP GET response message from the second component to the  
11 first component on the network connection;  
12 means for receiving the sent HTTP GET response message at the first component;  
13 means for extracting the server-initiated TCP request from the received HTTP GET  
14 response message; and  
15 means for forwarding the extracted server-initiated TCP request to the client on the first  
16 TCP connection.

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1 Claim 15 (original): The system according to Claim 14, wherein the means for transmitting  
2 server-initiated TCP requests further comprises:

3 means for performing a read operation on the second TCP connection, responsive to  
4 operation of the means for receiving the sent HTTP GET request message and prior to operation  
5 of the means for receiving the server-initiated TCP request; and

6 means for using the received server-initiated TCP request as a result of the read operation,  
7 thereby triggering operation of the means for packaging the received server-initiated TCP request  
8 in the HTTP GET response message.

1 Claim 16 (original): The system according to Claim 14, wherein the means for transmitting  
2 server-initiated TCP requests further comprises means for preparing to receive another server-  
3 initiated TCP request by triggering operation of the means for sending the HTTP GET request  
4 message from the first component to the second component, responsive to operation of the means  
5 for receiving the sent HTTP GET response message at the first component.

1 Claim 17 (original): The system according to Claim 11, wherein a Multi-Purpose Internet Mail  
2 Extensions (MIME) type of the HTTP POST request message is set to "binary/tcp".

1 Claim 18 (original): The system according to Claim 14, wherein a Multi-Purpose Internet Mail  
2 Extensions (MIME) type of the HTTP GET request message is set to "binary/tcp".



1 Claim 19 (original): A method for sending Transmission Control Protocol (TCP) messages  
2 through HyperText Transfer Protocol (HTTP) systems, comprising the steps of:  
3 establishing a send channel from a first component on a client side of a network  
4 connection, through one or more HTTP-based systems, to a second component on a remote side  
5 of the network connection;  
6 establishing a receive channel from the first component, through the one or more HTTP-  
7 based systems, to the second component;  
8 establishing a first TCP connection from a client on the client side to the first component;  
9 establishing a second TCP connection from the second component to a target server on  
10 the remote side;  
11 transmitting client-initiated TCP requests from the client to the target server on the send  
12 channel; and  
13 transmitting server-initiated TCP requests from the target server to the client on the  
14 receive channel.

1 Claim 20 (original): The method according to Claim 19, wherein the step of transmitting client-  
2 initiated TCP requests further comprises the steps of:  
3 receiving a client-initiated TCP request from the client at the first component on the first  
4 TCP connection;  
5 packaging the received client-initiated TCP request in an HTTP POST request message;  
6 sending the HTTP POST request message to the second component on the network  
7 connection;

8 receiving the sent HTTP POST request message at the second component;  
9 extracting the client-initiated TCP request from the received HTTP POST request  
10 message; and  
11 forwarding the extracted client-initiated TCP request to the target server on the second  
12 TCP connection.

1 Claim 21 (original): The method according to Claim 20, wherein the step of transmitting client-  
2 initiated TCP requests further comprises the step of acknowledging the HTTP POST request by  
3 sending an HTTP POST response from the second component to the first component on the  
4 network connection.

1 Claim 22 (original): The method according to Claim 21, wherein the step of establishing the send  
2 channel operates in response to the step of receiving the client-initiated TCP request, and wherein  
3 the step of transmitting client-initiated TCP requests further comprises the steps of:  
4 receiving the HTTP POST response at the first component; and  
5 closing the send channel, responsive to receiving the HTTP POST response.

1 Claim 23 (original): The method according to Claim 19, wherein the step of transmitting server-  
2 initiated TCP requests further comprises the steps of:  
3 sending an HTTP GET request message from the first component to the second  
4 component on the network connection;  
5 receiving the sent HTTP GET request message at the second component;

6 receiving a server-initiated TCP request from the target server at the second component  
7 on the second TCP connection;

8 packaging the received server-initiated TCP request in an HTTP GET response message  
9 which acknowledges the received HTTP GET request message;

10 sending the HTTP GET response message from the second component to the first  
11 component on the network connection;

12 receiving the sent HTTP GET response message at the first component;

13 extracting the server-initiated TCP request from the received HTTP GET response  
14 message; and

15 forwarding the extracted server-initiated TCP request to the client on the first TCP  
16 connection.

1 Claim 24 (original): The method according to Claim 23, wherein the step of transmitting server-  
2 initiated TCP requests further comprises the steps of:

3 performing a read operation on the second TCP connection, responsive to receiving the  
4 sent HTTP GET request message and prior to receiving the server-initiated TCP request; and

5 using the received server-initiated TCP request as a result of the read operation, thereby  
6 triggering the step of packaging the received server-initiated TCP request in the HTTP GET  
7 response message.

1 Claim 25 (original): The method according to Claim 23, wherein the step of transmitting server-  
2 initiated TCP requests further comprises the step of preparing to receive another server-initiated

3 TCP request by triggering the step of sending the HTTP GET request message from the first  
4 component to the second component, responsive to receiving the sent HTTP GET response  
5 message at the first component.

1 Claim 26 (original): The method according to Claim 20, wherein a Multi-Purpose Internet Mail  
2 Extensions (MIME) type of the HTTP POST request message is set to "binary/tcp".

1 Claim 27 (original): The method according to Claim 23, wherein a Multi-Purpose Internet Mail  
2 Extensions (MIME) type of the HTTP GET request message is set to "binary/tcp".

1 Claim 28 (original): A method for transporting bi-directional protocol traffic through uni-  
2 directional protocol systems, comprising the steps of:  
3 establishing a send channel from a first component on a client side of a network  
4 connection, through one or more uni-directional protocol-based systems, to a second component  
5 on a remote side of the network connection;  
6 establishing a receive channel from the first component, through the one or more uni-  
7 directional protocol-based systems, to the second component;  
8 establishing a first bi-directional protocol connection from a client on the client side to the  
9 first component;  
10 establishing a second bi-directional protocol connection from the second component to a  
11 target server on the remote side;  
12 transmitting client-initiated bi-directional protocol requests from the client to the target

13 server on the send channel; and  
14 transmitting server-initiated bi-directional protocol requests from the target server to the  
15 client on the receive channel.

1 Claim 29 (original): The method according to Claim 28, wherein the step of transmitting client-  
2 initiated bi-directional protocol requests further comprises the steps of:  
3 receiving a client-initiated bi-directional protocol request from the client at the first  
4 component on the first bi-directional protocol connection;  
5 packaging the received client-initiated bi-directional protocol request in a uni-directional  
6 protocol write request message;  
7 sending the uni-directional protocol write request message to the second component on  
8 the network connection;  
9 receiving the sent uni-directional protocol write request message at the second  
10 component;  
11 extracting the client-initiated bi-directional protocol request from the received uni-  
12 directional protocol write request message; and  
13 forwarding the extracted client-initiated bi-directional protocol request to the target server  
14 on the second bi-directional protocol connection.

1 Claim 30 (original): The method according to Claim 28, wherein the step of transmitting server-  
2 initiated bi-directional protocol requests further comprises the steps of:  
3 sending a uni-directional protocol read request message from the first component to the

4 second component on the network connection;

5 receiving the sent uni-directional protocol read request message at the second component;

6 receiving a server-initiated bi-directional protocol request from the target server at the

7 second component on the second bi-directional protocol connection;

8 packaging the received server-initiated bi-directional protocol request in a uni-directional

9 protocol read response message which acknowledges the received uni-directional protocol read

10 request message;

11 sending the uni-directional protocol read response message from the second component to

12 the first component on the network connection;

13 receiving the sent uni-directional protocol read response message at the first component;

14 extracting the server-initiated bi-directional protocol request from the received uni-

15 directional protocol read response message; and

16 forwarding the extracted server-initiated bi-directional protocol request to the client on the

17 first bi-directional protocol connection.